STAFF PAPER

Thermal Efficiency of Natural Gas-Fired Generation in California: 2016 Update

Michael Nyberg

Supply Analysis Office

Energy Assessments Division

California Energy Commission

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Edmund G. Brown Jr., Governor

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ABSTRACT

Senate Bill 1389 (Bowen and Sher, Chapter 568, Statutes of 2002) directed the California Energy Commission adopt an *Integrated Energy Policy Report* (IEPR) every two years. This staff paper supports the IEPR technical analyses by describing general trends in the average thermal efficiency of natural gas-fired generation in California from 2001 through 2015. Over this 15-year period, California's systemwide thermal efficiency for natural gas power plants improved by 23 percent. The successful development of new combined-cycle plants continues to be the primary reason for the improvement. The overall thermal efficiency of the state's current portfolio of noncogeneration natural gas power plants has resulted in 27 percent more energy being generated using almost 2 percent less natural gas compared to 15 years ago.

Keywords: Combined-cycle, heat rate, gas-fired generation, thermal efficiency

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Data Collection

Senate Bill 1389 (Bowen and Sher, Chapter 568, Statutes of 2002) directed the California Energy Commission adopt an *Integrated Energy Policy Report* (*IEPR*) every two years. This staff paper, the fifth in a series, supports technical analyses performed for the *IEPR* by describing general trends in the average thermal efficiency of natural gas-fired generation in California from 2001 through 2015. The paper incorporates power generation and fuel use data collected under the authority of the California Code of Regulations, Title 20, Division 2, Chapter 3, Section 1304(a) (1)-(2). The reporting requirement became effective on February 23, 2001, after the passage of California's major electricity restructuring legislation in 1996.

Data for this staff paper are obtained through the collection of the Energy Commission's CEC-1304 Power Plant Owner Reporting Form. Owners of power plants with a nameplate capacity of 1 megawatt (MW) or more serving California end users must report their respective generation, fuel, and water usage for each calendar year to the Energy Commission. *Nameplate capacity* is defined as the maximum rated output of a generator under specific conditions as designated by the manufacturer. It is commonly indicated on a nameplate attached to the generator.[1] The Energy Commission compiles and posts the data publicly on the Energy Commission's website.[2]

Data corrections since the previous 2016 staff paper have changed some of the historical data and information presented in this report. Corrections include minor adjustments of retirement dates for specific units, fuel usage reporting errors, and power generation revisions submitted by power plant owners. Also, staff discovered some power plants for which reporting had never occurred. The responsible parties were made aware of regulatory reporting requirements, and they filed as required. Some nameplate capacities were adjusted for units with partial year generation data due to either midyear commencement of commercial operation or retirement. Overall, the changes were modest. While some of the summary totals have changed, the trends as presented in previous staff papers remain the same.

Data have been compiled based on attributes of the generating units within each power plant and assigned to one of five categories. All data categories are mutually exclusive, and no unit is double-counted. As an example, the Rockwood Gas Turbine Plant in Brawley consists of two 24.95 MW combustion turbines (CTs). The first unit is a

1 Nameplate capacities may change over time as modifications are made to generating units.

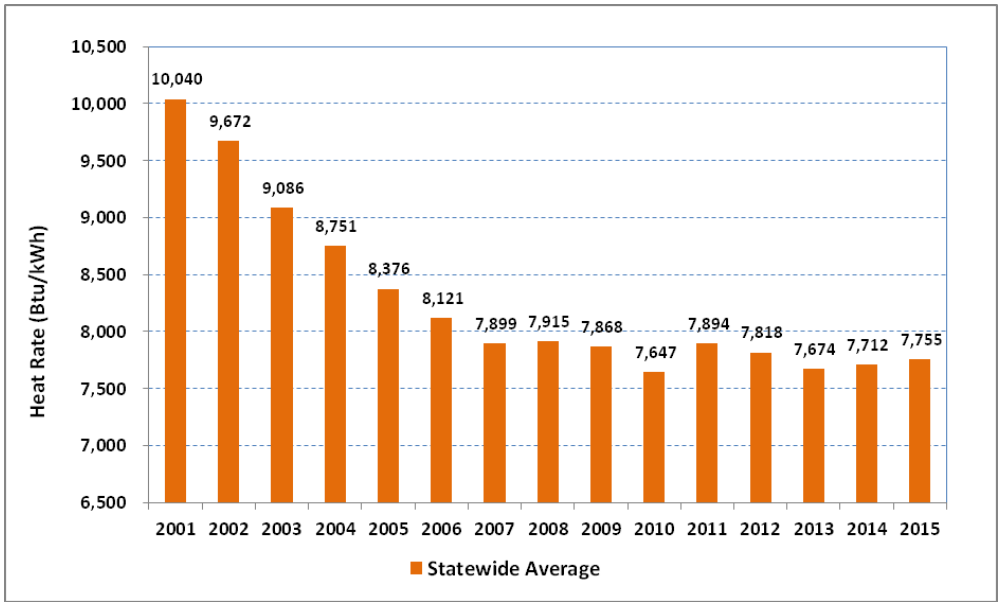
2 California Energy Commission website. QFER CEC-1304 Power Plant Owner Reporting Database. Accessed December 2016. See http://www.energy.ca.gov/almanac/electricity_data/web_qfer/.

dual-fuel gas turbine with the primary fuel being natural gas and diesel fuel used as a backup or secondary fuel. The second unit is operated exclusively with diesel fuel. [3] In this paper, only the dual-fuel unit is included in the statistics.

Trends in Heat Rates and Capacity Factors

The thermal efficiency of a natural gas-fired electric generation plant is typically described by measuring the heat rate. The *heat rate* of a power plant expresses how much fuel is necessary (measured in British thermal units [Btu]) to produce one unit of energy (measured in kilowatt-hours [kWh]). Therefore, the heat rate of California's natural gas-fired generation fleet is obtained by the ratio of total annual fuel use to total annual electrical energy generated. A lower heat rate indicates a more efficient system; however, there are practical limits to the state's achievable systemwide heat rate. Limiting factors include the location, elevation, and ambient weather conditions at each of the state's thermal power plant sites and the resulting impact on achievable fuel efficiency. Locational factors may also include emissions limits by air quality management districts, localized noise limits, and limits on hours of operation. **Figure 1** displays California's systemwide average heat rate over the past 15 years, excluding cogeneration. The overall thermal efficiency of the natural gas-fired fleet of power plants has improved by 23 percent since 2001.[4]

Figure 1: Statewide Average Natural Gas-Fired Heat Rate



Source: QFER CEC-1304 Power Plant Data Reporting.

3 Permit No. V, Imperial County Air Pollution Control District. *Major Facility Permit Review*. September 29, 2009. See https://yosemite.epa.gov/r9/air/epss.nsf/735056a63c1390e08825657e0075d180/5efd2adb8878924c8825766a006c755f/$FILE/V-1365%20IID%20Rockwood%20-%20Renewal%20Engineer%20Review%20(09-29-09).docx.

4 2015 Average Heat Rate = 7,755 British thermal units per kilowatt-hour (Btu/kWh).
2001 Average Heat Rate = 10,040 Btu/kWh.
Percentage Change in Heat Rate = (10,040 – 7,755)/10,040 = 22.76 percent.

In **Figure 1** there is an almost steady reduction of the average heat rate through 2010. The increase observed in 2011 was due to the large gains in available hydroelectric generation that year, the result of a wet hydrological year. Generally, when snowmelt and runoff are plentiful in California, hydroelectric energy is available during the spring and fall months at a much lower cost than natural gas. Therefore, in wet hydrological years, natural gas-fired generation is displaced (reduced) by low-cost hydroelectric generation. The magnitude of available hydroelectric generation resulted in curtailments of generation from the combined-cycle (CC) power plant fleet.

California entered the first of a multiyear drought in 2012, and in January of that same year, the 2,254 MW San Onofre Nuclear Generating Station shut down operation due to leaking steam generator tubes. These two events resulted in natural gas-fired power plants resuming higher levels of generation, with significant thermal efficiency improvement observable by 2013; the increased thermal efficiency results from gas-fired power plants running at higher operating levels that maximize the fuel-burn efficiency. The modest increases observed in the systemwide average heat rate in 2014 and 2015 were the result of natural gas-fired power plants adjusting the power output to accommodate fluctuations in available renewable generation within California's grid. This adjusting of power output on a daily and hourly basis is referred to as *ramping*.

Also known as *cycling*, ramping gas-fired power generation is necessary to balance the natural variation in the availability of wind and solar generation over specific hours of the day to meet system load. Ramping causes a degradation in the average heat rate of a natural gas-fired power plant, a result of the large temperature changes that take place in plant equipment during multiple shutdowns and restarts. For a plant type that is designed primarily to operate continuously, more ramping generally means greater wear and tear on the equipment and a lowering of the lifespan of the plant.

In 2015, there was a 1.9 percent drop in electric generation from natural gas-fired power plants, but fuel usage dropped only 1.3 percent. This suggests an overall loss in fuel efficiency. In fact, a 2 percent reduction in fuel usage by the state's most efficient natural gas-fired plants, combined with a 3 percent increase in fuel usage by the state's aging natural gas–fired plants, resulted in an increase of the annual average heat rate from 7,712 Btu/kWh to 7,755 Btu/kWh.

Despite the slight loss of fuel efficiency over the past two years, California continues to benefit from an overall improvement in the thermal efficiency of natural gas-fired generation due to an increase in generation from CC power plants built since 2000. California also benefited from a reduced dependency on generation from aging power plants. CC power plants have provided more than 40 percent of California's in-state electrical power and more than 85,000 gigawatt-hours (GWh) of generation each year since 2012. **Table 1** details the measured heat rates since 2001 for all categories of natural gas-fired power plants in California. Each category has maintained a relatively consistent heat rate over the 15-year period, while the overall statewide average has fluctuated based on the

annual power mix of the system. Chapter 2 describes each category of natural gas-fired power plants.

The *capacity factors* (CFs) shown in **Table 2** give an overview of how often California's fleet of natural gas-fired power plants operated each year. A CF is the ratio of electric generation over a selected period divided by the maximum potential output over the same period. For the initial year of commercial operation, CFs were calculated using a prorated nameplate capacity based on the number of hours the unit was available. For example, the 594 MW Los Medanos Energy Center had an effective annual nameplate capacity of 298 MW for the first year of operation in 2001 as it began operating on July 1.

On average, California's CC plants operated at CFs slightly more than 50 percent, while aging and peaker gas plants operated at 6 percent. This difference is to be expected due to efforts to minimize fuel costs by operating California's more efficient and less costly CC plants more often, leaving the inefficient aging plants and simple-cycle peaker plants for local reliability and peak-load handling needs.[5] For example, the newly constructed simple-cycle peaking units installed at the Haynes Generating Station in Long Beach, totaling 648 MW, operated at a 3.4 percent CF in 2015. In contrast, the new rapid-response CC design (fast-start turbines and dry-cooling) implemented at the El Segundo Energy Center, totaling 526 MW, operated at a 43 percent CF in 2015. These two examples, both brought on-line in 2013, illustrate the operational differences between modern peaker and modern CC power plants.

California's cogeneration plants operated at a 52.5 percent CF in 2015, down 2.5 percent from 2014. These plants are generally expected to run at relatively high and consistent CFs due to the unique aspect of delivering both useful steam and electricity. Over the past 15 years, the heat rate of these cogeneration plants averaged 11,292 Btu/kWh. However, given that these plants are producing thermal energy along with electrical energy, it is evident that a heat rate calculation that also accounted for the thermal output would result in a substantially lower effective heat rate than the simple calculation of fuel input versus electricity output indicates. The difficulty in assessing the efficiency gains related to the output of steam and useful heat are beyond the scope of this paper. For this reason, the cogeneration data are not included in the average heat rate calculations depicted in **Figure 1**. This treatment is consistent with industry standards as exemplified in the United States Energy Information Administration's (U.S. EIA) Form EIA-860, *Annual Electric Generator Report.*[6]

5 Aging Power Plant Workshop, May 18, 2004.
http://www.energy.ca.gov/2003publications/2004_policy_update/documents/2004-05-18_workshop/2004-05-19_AGING_PPS.PDF

6 U.S. EIA, Table 8.2. *Average Tested Heat Rates by Prime Mover and Energy Source, 2007 – 2013.*
http://www.eia.gov/electricity/annual/html/epa_08_02.html.

Table 1: California Natural Gas-Fired Heat Rates for 2001 – 2015 (Btu/kWh)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Combined-Cycle	6,973	7,147	7,209	7,177	7,230	7,229	7,190	7,147	7,196	7,181	7,270	7,205	7,205	7,270	7,304
Aging	10,125	10,531	10,837	10,917	11,279	11,282	11,033	11,133	11,594	11,681	12,299	11,709	11,413	11,777	11,683
Cogeneration	11,120	11,101	11,050	11,307	11,383	11,313	11,237	11,479	11,378	11,182	11,224	11,259	11,459	11,454	11,435
Peaker	11,227	10,790	10,713	10,817	10,816	10,751	10,881	10,588	10,821	11,011	10,739	10,838	10,321	10,307	10,214
Miscellaneous	10,137	9,528	10,338	9,952	9,936	9,979	9,980	10,066	10,397	9,924	9,601	9,527	9,485	9,298	9,422
State Average	10,391	10,302	9,903	9,706	9,507	9,131	8,856	8,870	8,819	8,652	8,979	8,611	8,538	8,532	8,538
State Average w/o Cogeneration	10,040	9,672	9,086	8,751	8,376	8,121	7,899	7,915	7,868	7,647	7,894	7,818	7,674	7,712	7,755

Source: QFER CEC-1304 Power Plant Data Reporting.

Table 2: California Natural Gas-Fired Power Plant Capacity Factors for 2001 – 2015

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Combined-Cycle	54.3%	65.8%	53.6%	58.6%	53.7%	53.8%	62.6%	62.4%	58.2%	51.9%	37.3%	55.1%	52.7%	51.9%	50.5%
Aging	41.9%	21.0%	15.4%	16.1%	9.9%	9.6%	9.0%	10.4%	7.6%	4.3%	4.1%	7.5%	5.8%	5.4%	5.9%
Cogeneration	68.0%	73.4%	71.3%	71.9%	66.3%	62.9%	64.4%	63.1%	61.2%	60.1%	59.1%	57.2%	56.6%	55.0%	52.5%
Peaker	12.5%	5.6%	3.9%	4.6%	4.1%	3.9%	4.3%	4.5%	4.1%	3.1%	3.6%	5.2%	5.3%	5.9%	6.0%
Miscellaneous	10.0%	9.9%	14.6%	15.1%	17.3%	16.2%	18.6%	19.5%	15.3%	17.5%	22.3%	21.6%	23.5%	23.0%	23.7%
State Average	44.9%	32.8%	30.3%	33.3%	30.0%	31.0%	34.3%	34.7%	32.2%	29.1%	24.1%	32.2%	30.8%	30.8%	30.6%

Source: QFER CEC-1304 Power Plant Data Reporting.

CHAPTER 2:
Natural Gas-Fired Power Plant Types

The natural gas-fired power plants examined in this paper are grouped into five categories based on a combination of duty cycles, vintage of the generators, and technology type. A detailed listing of all power plants, grouped by category, is included in Appendix A.

CC power plants comprise the first category. A CC power plant has a generation block consisting of at least one CT, a heat recovery steam generator, and a steam turbine (ST). The higher fuel efficiency results from the ability of the heat recovery steam generator to capture exhaust gas from the CTs to produce steam for the ST, often augmented with duct burning of natural gas in the heat recovery steam generator. For this report, CC power plants consist of those natural gas-fired generating blocks constructed in the 2000s with a total plant capacity of 100 MW or more.

In 2001, the 550 MW Sutter Energy Center in Yuba City (Sutter County) and the 594 MW Los Medanos Energy Center in Pittsburg (Contra Costa County) were the only CC power plants with this new technology; by 2015, California had 34 large CC plants totaling almost 20,000 MW in nameplate capacity. These newer plants produce electricity with better heat rates than either stand-alone CTs or STs. Historically, these plants have been used for baseload power. However, with the increasing deployment of variable renewable generation and the inherent "must-take" characteristics for dispatch by grid operators, CC plants are increasingly being tasked for flexible, load-balancing requirements that involve more frequent starts, ramping, and *load-following ancillary services*.

Load-following ancillary services are reserved electric generating capacity that can be increased or decreased through automated systems to allow continuous balance between generating resources and electricity demand. Load-following is understood as the difference in generation requirements between the hour-ahead energy forecast and the five-minute ahead forecast within a balancing authority, such as the California Independent System Operator (California ISO).[7] Deficiencies between the hour-ahead and five-minute-ahead forecasts are met by adjusting the output of power plants via load-following to ease sudden changes within the grid, such as the integration of variable solar and wind renewable energy.

The Aging category includes plants built and operational before 1980. Almost all are natural gas-fired steam turbines (STs) that use once-through-cooling (OTC) technology. Due to ongoing environmental concerns, a statewide OTC policy was adopted in 2010 requiring all owners of OTC plants to implement a best available control technology to achieve water

7 Makarov, Yuri V., Clyde Loutan, Jian Ma, and Phillip de Mello. 2009. *Operational Impacts of Wind Generation on California Power Systems*. See http://www.caiso.com/Documents/OperationalImpacts-WindGenerationonCaliforniaPowerSystems.pdf.

quality goals, specifically, a closed-cycle evaporative cooling system. Two compliance tracks were established to meet the new OTC policy:

Track 1. Reduce the intake flow rate at each power-generating unit to a level that can be attained with a closed-cycle evaporative cooling system. A minimum of 93 percent reduction is required compared to the design intake flow rate.

Track 2. If compliance with Track 1 is not feasible, reduce the impingement mortality and entrainment for the facility as a whole to 90 percent of Track 1 reductions, using operational or structural controls, or both.

Alternatively, a plant can comply by shutting down.[8] In 2001, prior to the implementation of the OTC policy, there were 27 aging natural gas-fired power plants with an operational nameplate capacity of almost 20,000 MW. By 2015, some five years after the OTC policy went into effect, there were 17 aging natural gas-fired power plants operating with a combined nameplate capacity of 13,182 MW.

The Cogeneration category consists of a mix of CTs, CC units, and STs. These plants, commonly referred to as *combined heat and power*, or *CHP*, plants, produce heat for an onsite or nearby dedicated thermal host, such as a petroleum refinery or college campus, and electricity for onsite industrial use or wholesale supply to the electrical grid. Cogeneration plants may also be qualifying facilities (QFs) under the Code of Federal Regulations Public Utility Regulatory Policies Act of 1978 (PURPA).

Under PURPA, a QF receives special electricity rates and regulatory treatment. Cogeneration plants with QF status are guaranteed that the local utility will take all of the power generated while providing heat or steam to their thermal host. PURPA regulations resulted in cogeneration QFs operating at high CFs for consistent thermal production with the guarantee that the local utility would take the electric power generation at favorable rates. The number of cogeneration plants reporting is relatively consistent from 2001 through 2015. There were 151 in January 2001 and 131 plants at the end of 2015. Total capacity for cogeneration plants in 2015 is 5,932 MW, down 445 MW from 2001. The majority of cogeneration plants in California are less than 50 MW in size, often in the 1 MW to 10 MW range.

The Peaker category consists solely of simple-cycle generating units. These units have a peaking duty cycle role—specifically, they are called upon to meet peak demand loads for a few hours on short notice, often in the 15-minute or 5-minute-ahead real-time market. This group also includes newer load-following plants such as the Panoche Energy Center. At 400 MW, the Panoche Energy Center is considered to be the largest peaking facility in the United States. Panoche's four 100-MW simple-cycle units are designed to ramp from a cold start to full load in 9.5 minutes and operate up to 5,000 hours per year with up to 365 start-

8 California Energy Commission Tracking Progress. *Once-Through Cooling Phase Out.* http://www.energy.ca.gov/renewables/tracking_progress/documents/once_through_cooling.pdf.

ups and shutdowns per year. In 2001 there were 29 peaker plants in California; by 2015 the number grew to 74 facilities.

All remaining natural gas-fired power plants are included in the Miscellaneous category. These include technologies such as fuel cell and reciprocating engine applications, turbine testing facilities, as well as older generating units built before the 2000s that are not considered to be peakers, cogeneration, or aging. This category also includes CC plants composed of repurposed older CTs and STs.

A change from previous staff papers is the inclusion of the 47.8 MW THUMS Long Beach simple-cycle power plant in the Miscellaneous category instead of the Peaker category. The THUMS power plant gets the name from the original oil company shareholders: Texaco, Humble, Union, Mobil, and Shell. While seemingly fitting the configuration of a peaking plant, THUMS is more appropriately included in this category based on the extremely high CF of more than 80 percent, an indication it is not operating in a peaking duty cycle role. The THUMS power plant provides power for oil and gas production around the Port of Long Beach. Overall, there are fewer than 20 plants in this category for each year studied.

Table 3 summarizes in-state natural gas-fired electric generation in 2015, with breakouts for five categories of natural gas-fired generation. Heat rates are averages by category and cannot be added together.

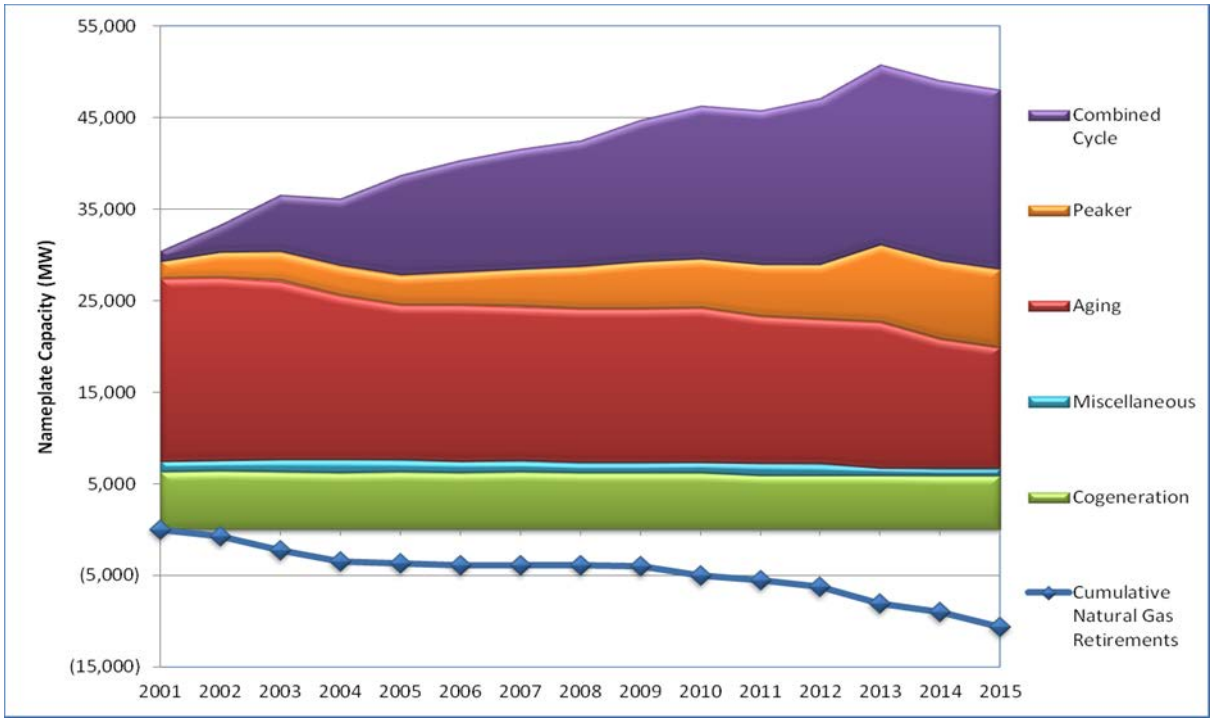
Table 3: California Natural Gas-Fired Power Plant Summary Statistics for 2015

Category	Capacity (MW)	Share of Capacity	GWh	Share of GWh	Capacity Factor	Heat Rate (Btu/KWh)
State Total (All Types)	48,175	100.0%	126,919	100.0%	30.6%	8,538
State Total (w/o Cogeneration)	42,243	N/A	99,908	N/A	26.9%	7,755
Cogeneration	5,932	12.3%	27,011	21.3%	52.5%	11,448
Combined-Cycle	19,700	40.8%	87,181	68.7%	50.5%	7,304
Aging	13,182	27.4%	6,452	5.1%	5.9%	11,683
Peaker	8,469	17.6%	4,425	3.5%	6.0%	10,213
Miscellaneous	892	1.9%	1,850	1.4%	23.7%	9,424

Source: QFER CEC-1304 Power Plant Data Reporting.

The total annual operational capacity of each category is shown **Figure 2**. Over the past 15 years, peaker and CC categories have expanded in capacity, aging plants have slowly but steadily retired, and the Cogeneration category has only marginally lost a few hundred MW of power. Cumulatively, by the close of 2015, almost 11,000 MW of natural gas-fired generation had been retired since 2001, as shown in **Figure 2** by a single line below the stacked-area graph.

Figure 2: Annual Natural Gas-Fired Capacity by Plant Category

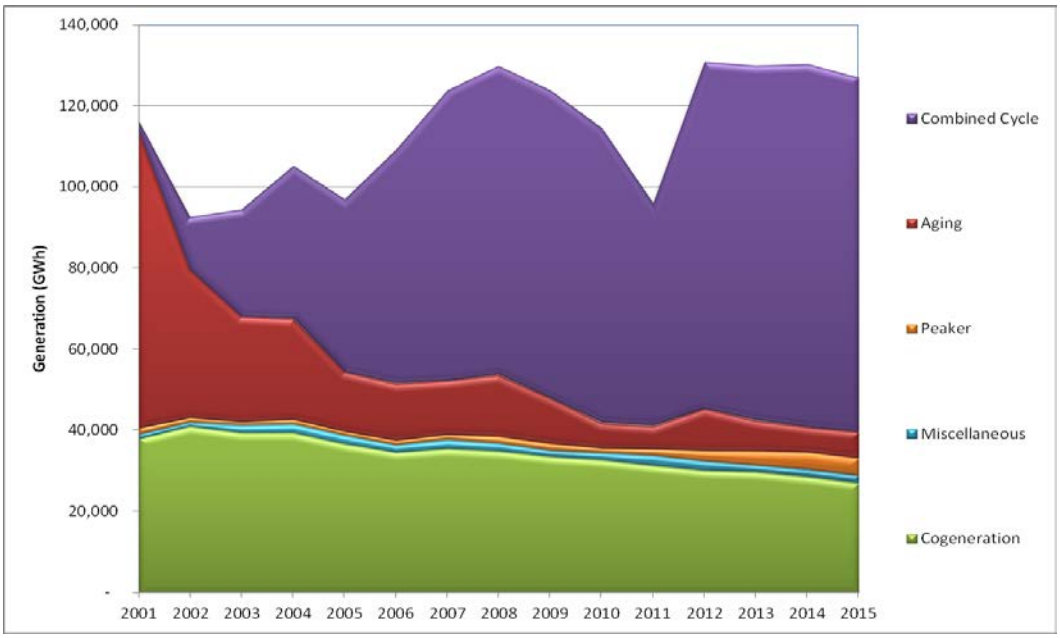


Source: QFER CEC-1304 Power Plant Data Reporting.

CHAPTER 3:
Natural Gas-Fired Generation

Over the past four years, natural gas-fired power plants have consistently provided 43 percent of California's total electric system power requirements. In 2015, roughly 48,000 MW of natural gas-fired electric generation capacity supplied 126,695 GWh of California's total electrical energy need of 295,405 GWh for the year. **Figure 3** illustrates the annual electric generation from five categories of natural gas-fired power plants directly serving California end users over the past 15 years.[9]

Figure 3: Natural Gas-Fired Electric Generation in California



Source: QFER CEC-1304 Power Plant Data Reporting.

California's aging power plants accounted for only 5 percent (6,452 GWh) of natural gas-fired electric generation in 2015 but still hold 27 percent of the state's natural gas-fired generation capacity, nominally rated at 13,182 MW, down from 19,890 MW in 2001. With an average heat rate of 11,683 Btu/kWh, California's aging plants also carry the distinction of having the poorest heat rates. The low CFs suggests the primary value of this group of power plants is in providing capacity support for local reliability that may include *voltage*

9 In-state natural gas-fired generation did not change appreciably from 2012 through 2015 despite drastically reduced hydroelectric generation as a result of the severe drought. Three other factors were major contributors to supplying California's demand during those years: reduced loads, large increases in solar photovoltaic systems, and growth in utility-scale wind generation.

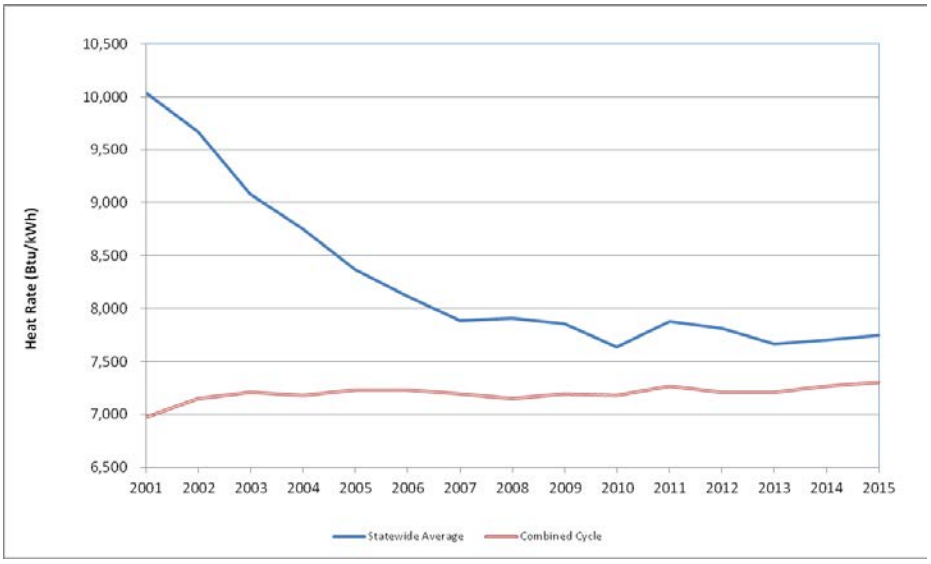
control, frequency control, and other ancillary services.[10] Control of voltage and frequency within a power system are essential to maintaining the balance between generation and load.

Voltage control in an alternating current (AC) power system is defined as the ability to adjust for changes in *reactive power*. Reactive power supports the magnetic and electric fields required for AC power systems to function. *Frequency control* is defined as the ability to dispatch generation due to decreases in supply or increases in load within a power system.

Statewide capacity of the newest group of natural gas-fired plants, CCs, is almost 20,000 MW. These plants account for 41 percent of California's total natural gas-fired generation capacity. In 2015, they provided 69 percent (87,181 GWh) of the total energy from natural gas-fired generation categories. Also, CC plants operated at an average CF of 51 percent and had an average heat rate of 7,304 Btu/kWh in higher heating value terms. The impact from this large growth in CC plants has been to reduce reliance upon the state's fleet of aging power plants, now operating at a minimal 6 percent CF despite 13,182 MW of operating capacity.

Figure 4 shows how the average heat rate for natural gas-fired generation in California has improved over the majority of the past 15 years. These gains in power plant efficiency are cumulative and result in direct reductions in greenhouse gases (GHGs) as the heat rate is directly proportional to GHG emissions.

Figure 4: Average Heat Rates for Natural Gas-Fired Electric Generation Serving California



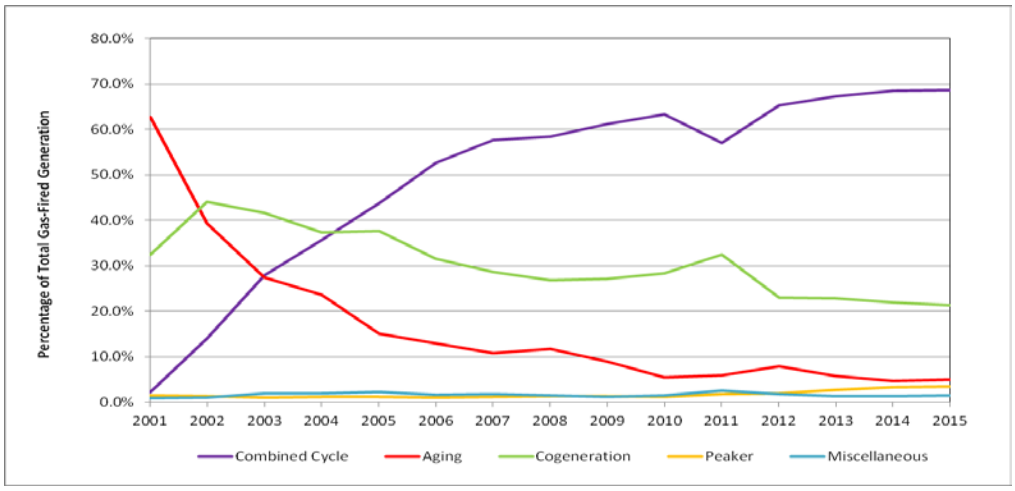
Source: QFER CEC-1304 Power Plant Data Reporting.

10 California Energy Commission. *The Role of Aging and Once-Through-Cooling Power Plants in California—An Update.* CEC-200-2009-018. See http://www.energy.ca.gov/2009publications/CEC-200-2009-018/CEC-200-2009-018.PDF.

Judging by the slope of the statewide average heat rate trend line in **Figure 4**, the greatest efficiency gains occurred from 2001 through 2010, a period when most CC plants began commercial service. As discussed in Chapter 1, the displacement of natural gas-fired generation by abundant hydroelectric power in 2011 resulted in a higher heat rate that year. Ramping by natural gas plants in 2014 through 2015 to accommodate newly developed solar and wind generation facilities has caused the most recent increases in the systemwide average heat rate. However, overall there have been large reductions in statewide GHG emissions as hydroelectric, solar, and wind generation have zero GHG emissions compared to even the most efficient natural gas-fired power plant.

Figure 5 illustrates how power generated from CC plants has surpassed (or displaced) the peak generation from aging power plants in recent years. In 2001, aging power plants generated 63 percent (73,041 GWh) of total energy from natural gas, while CC plants generated only 2 percent (2,730 GWh). By 2015, CC plants generated 69 percent (87,181 GWh) of total energy from natural gas while aging plants accounted for 5 percent (6,452 GWh). The total capacity of CC plants in 2015 now equals the 2001 capacity levels of California's aging plants in 2001 at almost 20,000 MW. Aging plants account for 13,182 MW of nameplate capacity in 2015.

Figure 5: Percentage of Total Natural Gas-Fired Generation by Plant Type



Source: QFER CEC-1304 Power Plant Data Reporting.

Table 4 and **Table 5** show energy generation and fuel use for each natural gas-fired generation category over the past 15 years. In 2015, California's natural gas-fired plants generated 10,515 GWh more than 2001 and used 125,984 GBtu (10^9 British thermal units) less natural gas than was used in 2001, representing an 18 percent gain in efficiency. If the cogeneration category is removed from the comparison, the efficiency improvement increases to 23 percent over the 15-year period. This efficiency improvement in the state's mix of natural gas-fired power plants has provided a direct reduction in GHG emissions from what would have been the case if CC power plants had not been introduced to the power mix.

Table 4: Generation from California's Natural Gas-Fired Power Plants 2001 – 2015 (GWh)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Combined-Cycle	2,730	12,954	26,335	37,605	42,576	57,481	71,357	75,936	75,706	72,649	54,878	85,397	87,361	89,411	87,181
Aging	73,037	36,535	25,886	24,937	14,641	14,136	13,342	15,304	11,198	6,218	5,680	10,424	7,588	6,221	6,452
Cogeneration	37,882	40,910	39,307	39,340	36,536	34,529	35,472	34,803	33,516	32,614	31,294	30,145	29,671	28,595	27,011
Peaker	1,715	1,308	1,056	1,280	1,176	1,181	1,421	1,780	1,768	1,405	1,743	2,569	3,513	4,363	4,425
Miscellaneous	1,040	1,029	1,911	2,107	2,195	1,890	2,173	1,997	1,551	1,762	2,504	2,366	1,828	1,792	1,850
State Total	116,404	92,736	94,495	105,269	97,124	109,217	123,765	129,820	123,739	114,648	96,099	130,901	129,961	130,382	126,919

Source: QFER CEC-1304 Power Plant Data Reporting.

Table 5: Natural Gas Usage for California's Power Plants 2001 – 2015 (Thousand MMBtu)

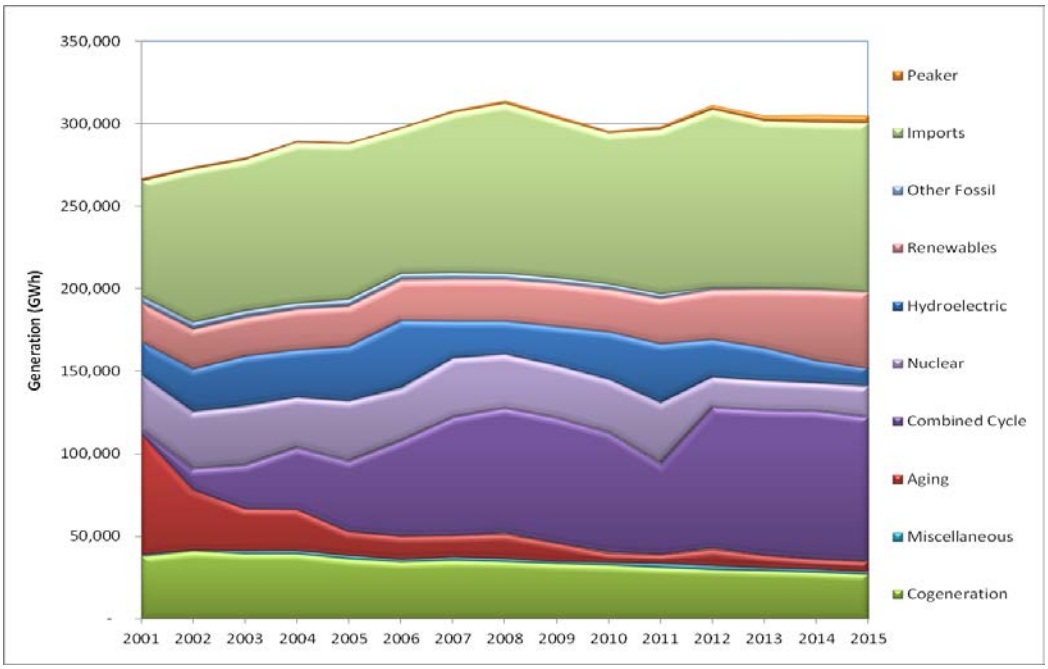
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Combined-Cycle	19,036	92,581	189,850	269,908	307,828	415,525	513,084	542,740	544,781	521,691	398,968	615,296	629,434	650,038	636,741
Aging	739,532	384,761	280,520	272,229	165,139	159,487	147,207	170,374	129,825	72,632	69,859	122,057	86,600	73,267	75,379
Cogeneration	421,238	454,126	434,340	444,807	415,895	390,640	398,585	399,492	381,338	364,689	351,244	339,388	340,004	327,523	308,871
Peaker	19,255	14,114	11,313	13,845	12,720	12,697	15,462	18,846	19,132	15,471	18,717	27,843	36,257	44,698	45,194
Miscellaneous	10,543	9,805	19,755	20,968	21,809	18,860	21,687	20,101	16,126	17,486	24,041	22,541	17,338	16,662	17,435
State Total	1,209,604	955,387	935,778	1,021,757	923,391	997,209	1,096,025	1,151,553	1,091,202	991,969	862,829	1,127,125	1,109,633	1,112,458	1,083,620

Source: QFER CEC-1304 Power Plant Data Reporting.

California's Total System Power

Total system power is a method of accounting for the complete fuel source profile of electric generation serving California by showing the total annual energy requirement for all load-serving entities with end-use loads in California. **Figure 6** summarizes the energy contribution from each of the five natural gas-fired power plant categories from 2001 through 2015, together with all other fuel types serving California, to provide the context of natural gas-fired generation within the total system power mix.

Figure 6: California Total System Power



Source: QFER CEC-1304 Power Plant Data Reporting.

California obtains roughly two-thirds of its power (about 200,000 GWh) from power plants within the state while importing the remaining one-third of its power (nearly 100,000 GWh) from surrounding states within the Western Electricity Coordinating Council region. The council is a nonprofit corporation that exists to assure a reliable electric system in the western United States, western Canada, and northern Baja California, Mexico.

Imported energy plays a large role in shaping the state's overall efficiency. Part of this imported energy is composed of long-term contracts by California utilities with out-of-state renewable and nonrenewable power plants, referred to as *specific claims* by utilities. The remainder of the imported energy category is from short-term, spot-market purchases that can also be considered specific claims if a power plant is identified or, if the original power plant is not able to be identified, *unspecified power*. Unspecified power is energy that cannot be directly traced back to the originating power plant. It makes up about 15 percent of total system power.

Generally, the unspecified power category would consist of short-term market purchases from those power plants that do not have a contract with a California utility. Much of the Northwest spot market purchases would probably be served by surplus large hydroelectric generators rated at more than 30 MW in nameplate capacity and CC power plants as marginal supply to California. Hydroelectric facilities rated less than 30 MW are generally considered to be eligible as renewable energy and would typically be contracted by a California utility to meet the state's Renewables Portfolio Standard. Spot market purchases from the Southwest would most likely be energy from CC and coal-fired power plants. Large solar renewable projects are already contracted under long-term specified contracts with California utilities and others to meet renewable energy mandates.

Finally, there is the issue of null power. *Null power* refers to power that was originally renewable power but from which the renewable energy certificates have been unbundled from the energy and sold, and ultimately retired, separately. Renewable energy certificates do not have to be used in the same year as the associated energy procured. Accordingly, null power is, by definition, not attributable to any technology or fuel type and may make up some portion of unspecified power in any given year.

CHAPTER 4:
Changes in Hourly Generation

Table 6 illustrates hourly operational differences, in megawatt-hours, between 2014 and 2015 for three categories of natural gas-fired power plants that operate within the California ISO balancing area. The California ISO is one of four balancing authorities in California and manages almost 80 percent of the state's total electric service territory. The information used is based on hourly data obtained from the California ISO. For each year and associated peak days, the average hourly output and standard deviation were calculated using all non-zero energy values for each hour.

Table 6: California ISO Average Hourly Natural Gas-Fired Generation Summary

	Combined-Cycle		Aging		Peakers	
	2015	**2014**	**2015**	**2014**	**2015**	**2014**
Annual Generation (MWh)	70,905,949	73,606,047	4,629,336	4,088,319	3,727,169	3,477,757
Average Hourly Output (MWh)	332	350	104	96	50	51
Standard Deviation (MWh)	173	175	113	97	59	58
Hourly Observations >1 MWh	213,688	210,228	44,561	42,484	74,433	67,792
High Load Day	**9/10/2015**	**9/15/2014**	**9/10/2015**	**9/15/2014**	**9/10/2015**	**9/15/2014**
Generation Output (MWh)	304,033	299,206	99,652	73,481	19,617	22,277
Average Hourly Output (MWh)	384	374	164	148	52	49
Standard Deviation (MWh)	172	172	165	126	59	53
Hourly Observations >1 MWh	792	801	606	497	388	455

Source: California ISO aggregated data.

The peak-load day within the California ISO for 2015 occurred on Thursday, September 10, with the instantaneous peak load of 47,358 MW occurring at 4:53 p.m. Similarly, in 2014 the instantaneous peak load also occurred at 4:53 p.m., however, at a lower value of 45,089 MW on Monday, September 15. For comparison, both dates fall closely within the same month and during a weekday, thereby avoiding the significantly different load profiles that occur on weekends and holidays. By falling closely within the same month, the corresponding solar insolation periods, a measure of solar radiation, are similar as well.

In comparing the operation of CC units within the California ISO across both years, the average hourly output of 332 MWh in 2015 was 5 percent lower than the previous year, while the total annual generation was down almost 4 percent at just over 70,000 GWh. Accounting for only non-zero hourly MWh observations as summarized in **Table 6,** the data show that CC units within the California ISO generated less energy across more hours compared to 2014. The

variability of hourly output for this group, as defined by the standard deviation, was similar to 2014 levels at nearly 173 MWh, indicating significant swings in power generation on an hourly basis over the year. Of almost 214,000 observations of hourly generation in 2015, CC units generated between 159 MWh and 505 MWh 67 percent of the time. The implication is that CC units were being ramped up and down more frequently in 2015 to integrate must-take intermittent renewable generation.

Aging units within the California-ISO generated 13 percent more energy (4,629 GWh) in 2015 with a higher average hourly output of 104 MWh and had higher hourly variability across more hours than in 2014. While delivering only 5 percent of the state's total natural gas-fired energy, aging plants continue to be used for system and local reliability through ramping to follow net load and for providing flexible capacity support in the event of transmission outage or a major equipment failure at a nearby power plant.

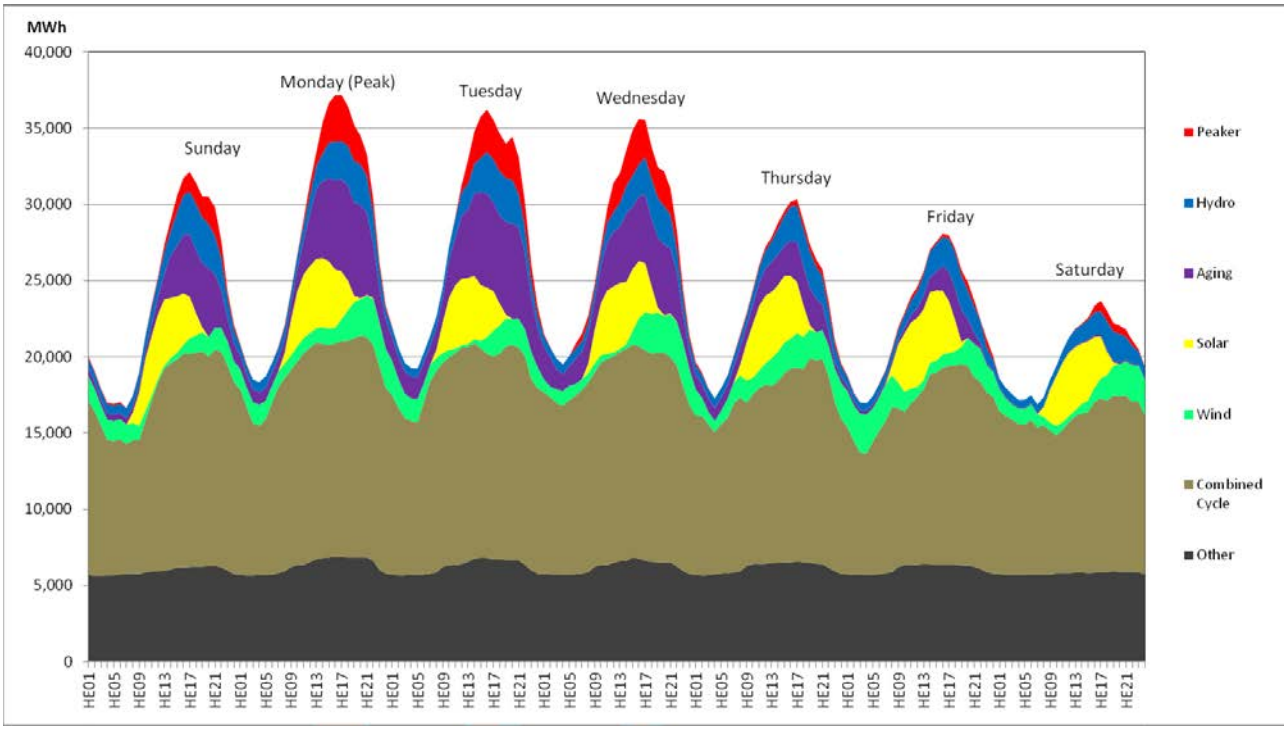
As expected, peaker units had a similar average hourly output level to 2014 of 51 MWh while operating 10 percent more hours. With most units sized at 49.9 MW in nameplate capacity, the data show that peakers continue to be used as intended, either completely on or off. The average is skewed above 50 MW due to the inclusion of newer load-following plants, such as the four 100 MW CTs of the Panoche Energy Center in this category. Peakers had 18 percent more variability in 2015, suggesting that system electric loads may have been more variable compared to loads in 2014. With inherent fast-ramping capabilities, peakers may also be supporting the integration of variable renewable energy.

Figure 7 and **Figure 8** show the contribution of CC, aging, and peaker plant generation to the hourly load across the week on which the peak-load day occurred in each year. Solar, wind, and hydroelectric generation are included separately along with an Other category that groups biomass, geothermal, nuclear, refinery waste heat turbines, petroleum coke, and cogeneration into a single category.

While it is apparent there is some ramping of the Other category during peak hours of the day, both charts show significant ramping of the CC, hydroelectric, peaker, and aging categories. Solar facilities maximize power output at noon each day when solar irradiance, the rate at which solar energy falls onto the earth, is at its peak; this typically occurs a few hours before California's peak demand for electricity. Wind, on the other hand, typically generates maximum output during off-peak hours, thereby also missing the state's daily peak demand hours.

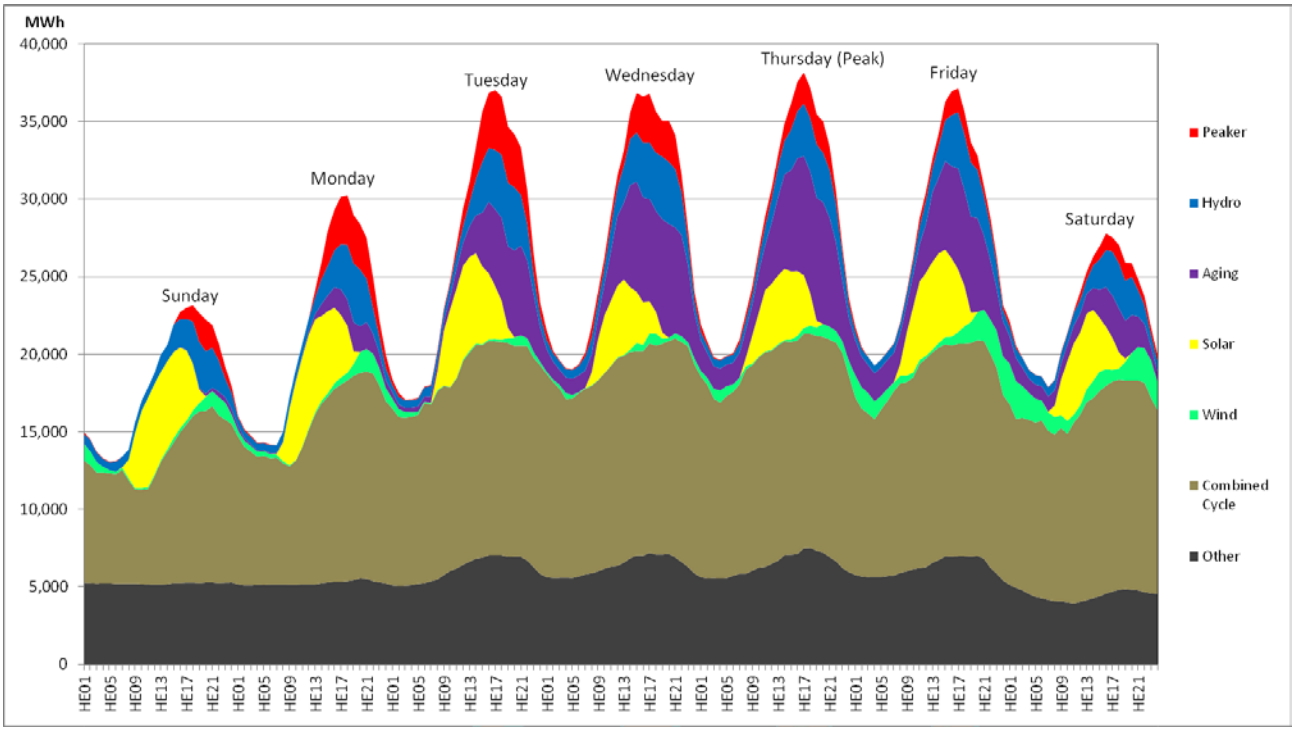
Both wind and solar technologies are considered to be "must-take" generation by the California ISO. They are energy resources that are not operated in a traditional sense but may be curtailed during periods of overgeneration on the system. Other fossil and hydroelectric generators are ramped up or down to accommodate the natural daily fluctuations in renewable energy output. It is this ramping for natural gas-fired units that negatively impacts the overall heat rate but still achieves fuel savings for hours not operated due to renewable energy availability.

Figure 7: California ISO Hourly System Load During September 14 – 20, 2014



Source: California ISO aggregated data.

Figure 8: California ISO Hourly System Load During September 6 – 12, 2015



Source: California ISO aggregated data.

CHAPTER 5: Conclusion

California has experienced a significant improvement in the systemwide thermal efficiency of its natural gas-fired power plants over the last 15 years. From 2001 to 2015, the systemwide thermal efficiency has improved 23 percent. This improvement in efficiency is due to the increased reliance upon new CC power plants that are operating at a 51 percent CF. By contrast, aging power plants are operating at a 6 percent CF, down 36 percent since 2001.

California has benefitted from this improved thermal efficiency in terms of GHG emission reductions, although the closure of the San Onofre Nuclear Generating Station in 2012 and the ongoing drought have temporarily dampened this effect. While natural gas-fired generation continues to provide the necessary available capacity for grid reliability and to offset unplanned capacity losses from other forms of generation, the substantial increases in renewable generation from wind and solar are helping provide long-term GHG emission reductions. Overall, any temporary increases in GHG emissions from the natural gas-fired power generation fleet should not impact the state's ability to achieve a reduction in GHG emissions to 1990 levels by 2020, as mandated by Assembly Bill 32, the Global Warming Solutions Act (Núñez, Chapter 488, Statutes of 2006).

ACRONYMS

Acronym	Definition
Btu	British thermal unit
California ISO	California Independent System Operator
CC	Combined cycle
CF	Capacity factor
CT	Combustion turbine
Energy Commission	California Energy Commission
GHG	Greenhouse gas
GWh	Gigawatt-hour
HRSG	Heat recovery steam generator
IEPR	Integrated Energy Policy Report
kWh	Kilowatt-hour
MMBtu	Million British thermal units
MW	Megawatt
MWh	Megawatt-hour
OTC	Once-through-cooling
PURPA	Public Utility Regulatory Policies Act of 1978
QF	Qualifying facility
QFER	Quarterly Fuels and Energy Report
ST	Steam turbine
U.S. EIA	United States Energy Information Administration
WECC	Western Electricity Coordinating Council

APPENDIX A:
Natural Gas Power Plants

Table A-1 lists all natural gas-fired power plants directly serving California end users. These plants are grouped by category and are listed with the associated nameplate capacity as of 2015. The capacities represent only the generating units included within each category. It is possible for power plants to be listed in more than one category due to having multiple generating units. Furthermore, nameplate capacities change over time due to units being upgraded, downsized, or reconfigured into a completely different operating mode. For example, there are a few examples of power plants reconfiguring specific units from a peaking duty cycle into a CC unit through the addition of an ST. For these reasons, only the most recent 2015 nameplate capacity is listed. Detailed generating unit information for all 15 years of data is available for download from the Energy Commission's website.[11]

The listing includes two natural gas-fired power plants in Mexico and one plant in Nevada. As California's electrical boundaries are not limited to its borders, there are power plants in Nevada, Arizona, Utah, and Mexico that are within a California balancing authority's territory. Accordingly, these out-of-state plants are dynamically scheduled in the same manner as a California power plant and are, therefore, distinct from the more typical imported power California receives through bulk power exchanges between separate balancing authorities.

11 California Energy Commission website. QFER CEC-1304 Power Plant Owner Reporting Database. Accessed December 2016. See http://www.energy.ca.gov/almanac/electricity_data/web_qfer/.

Table A-1: Natural Gas-Fired Power Plants Directly Serving California

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Aging	G0011	Alamitos	FALSE	Long Beach	Los Angeles	CA	1,969.8
Aging	G0061	Broadway	FALSE	Pasadena	Los Angeles	CA	75.0
Aging	G0147	Contra Costa Power Plant - Retired 5/1/2013	TRUE	Antioch	Contra Costa	CA	N/A
Aging	G0190	El Centro Generating Station	FALSE	El Centro	Imperial	CA	81.6
Aging	G0194	El Segundo Power Station (for Unit 3 and 4) - Retired 12/31/2015	TRUE	El Segundo	Los Angeles	CA	335.0
Aging	G0196	Encina	FALSE	Carlsbad	San Diego	CA	951.0
Aging	G0201	Etiwanda Generating Station	FALSE	Rancho Cucamonga	San Bernardino	CA	666.0
Aging	G0236	Grayson	FALSE	Glendale	Los Angeles	CA	238.0
Aging	G0245	Harbor	FALSE	Wilmington	Los Angeles	CA	N/A
Aging	G0249	Haynes Generating Station	FALSE	Long Beach	Los Angeles	CA	460.0
Aging	G0268	Humboldt Bay	FALSE	Eureka	Humboldt	CA	N/A
Aging	G0272	Hunters Point - Retired 5/15/2006	TRUE	San Francisco	San Francisco	CA	N/A
Aging	G0274	Huntington Beach (AES)	FALSE	Huntington Beach	Orange	CA	430.0
Aging	G0319	Long Beach Generation LLC	FALSE	Long Beach	Los Angeles	CA	N/A
Aging	G0329	Magnolia	FALSE	Burbank	Los Angeles	CA	N/A
Aging	G0330	Mandalay Generating Station	FALSE	Oxnard	Ventura	CA	435.2
Aging	G0371	Morro Bay Power Plant - Retired 2/5/2014	TRUE	Morro Bay	San Luis Obispo	CA	N/A
Aging	G0372	Moss Landing Power Plant	FALSE	Moss Landing	Monterey	CA	1,404.0
Aging	G0410	Olive	FALSE	Burbank	Los Angeles	CA	109.8
Aging	G0421	Ormond Beach Generating Station	FALSE	Oxnard	Ventura	CA	1,612.8
Aging	G0450	Pittsburg Generating Station	FALSE	Pittsburg	Contra Costa	CA	1,370.0
Aging	G0462	Potrero Generating Station - Retired 2/28/2011	TRUE	San Francisco	San Francisco	CA	N/A
Aging	G0490	Redondo Beach LLC_(AES)	FALSE	Redondo Beach	Los Angeles	CA	1,355.7

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Aging	G0549	Scattergood	FALSE	Del Rey	Los Angeles	CA	823.0
Aging	G0571	South Bay Power Plant - Retired 12/31/2010	TRUE	Chula Vista	San Diego	CA	N/A
Aging	G0648	Valley Generating Station	FALSE	Sun Valley	Los Angeles	CA	N/A
Aging	G0767	Coolwater Generating Station - Retired 1/15/2015	TRUE	Daggett	San Bernardino	CA	726.7
Cogeneration	G0006	CES Placerita Inc. (CESP) - Retired 12/31/2010	TRUE	Newhall	Los Angeles	CA	N/A
Cogeneration	G0019	Calpine King City Cogeneration LLC	FALSE	King City	Monterey	CA	130.0
Cogeneration	G0028	Cenveo Anderson Lithograph - Retired 5/1/2009	TRUE	Commerce	Los Angeles	CA	N/A
Cogeneration	G0031	Oxford Cogeneration Facility - Retired 12/31/2006	TRUE	Fellows	Kern	CA	N/A
Cogeneration	G0032	Berry Placerita Cogen	FALSE	Santa Clarita	Los Angeles	CA	42.8
Cogeneration	G0034	Tesoro LAR Carson (formerly ARCO)	FALSE	Carson	Los Angeles	CA	12.0
Cogeneration	G0035	Watson Cogeneration Co	FALSE	Carson	Los Angeles	CA	398.0
Cogeneration	G0040	Badger Creek Cogen	FALSE	Bakersfield	Kern	CA	47.0
Cogeneration	G0054	Biola University	FALSE	La Mirada	Los Angeles	CA	2.2
Cogeneration	G0056	Santa Maria Cogen Plant - Retired 12/31/2013	TRUE	Santa Maria	Santa Barbara	CA	N/A
Cogeneration	G0076	Sacramento Campbell Soup SPA	FALSE	Sacramento	Sacramento	CA	174.0
Cogeneration	G0077	Laguna Plant Cogen Facility	FALSE	Santa Rosa	Sonoma	CA	N/A
Cogeneration	G0078	Wilmington - Air Products	FALSE	Wilmington	Los Angeles	CA	31.9
Cogeneration	G0080	Cardinal Cogen - Retired 3/31/2015	TRUE	Stanford	Santa Clara	CA	53.6
Cogeneration	G0084	Carson Cogeneration Co	FALSE	Carson	Los Angeles	CA	60.0
Cogeneration	G0085	Sacramento Carson - Carson Ice CG	FALSE	Sacramento	Sacramento	CA	119.5
Cogeneration	G0087	San Jose Cogeneration	FALSE	San Jose	Santa Clara	CA	7.0
Cogeneration	G0100	Coalinga Cogeneration Plants	FALSE	Coalinga	Fresno	CA	16.6
Cogeneration	G0101	Chevron Concord Cogeneration - Retired 7/27/2010	TRUE	Concord	Contra Costa	CA	N/A
Cogeneration	G0102	Cymric Cogeneration Plants	FALSE	McKittrick	Kern	CA	21.0
Cogeneration	G0103	Kern River Eastridge Cogeneration Plant	FALSE	Bakersfield	Kern	CA	48.8

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Cogeneration	G0104	Chevron Richmond Refinery Cogeneration	FALSE	Richmond	Contra Costa	CA	165.7
Cogeneration	G0105	Chevron El Segundo Refinery Cogeneration	FALSE	El Segundo	Los Angeles	CA	183.2
Cogeneration	G0107	Taft 26C Cogeneration Plant	FALSE	Taft	Kern	CA	10.0
Cogeneration	G0109	Childrens Hospital #2	FALSE	San Diego	San Diego	CA	5.3
Cogeneration	G0114	Santa Clara Cogen	FALSE	Santa Clara	Santa Clara	CA	7.8
Cogeneration	G0119	Municipal Cogeneration Plant Palm Springs - Retired 5/1/2014	TRUE	Palm Springs	Riverside	CA	1.3
Cogeneration	G0121	San Jose Convention Center - Retired 12/31/2003	TRUE	San Jose	Santa Clara	CA	N/A
Cogeneration	G0131	Coalinga Cogeneration	FALSE	Coalinga	Fresno	CA	38.4
Cogeneration	G0144	Altivity Packaging - Santa Clara	FALSE	Santa Clara	Santa Clara	CA	25.0
Cogeneration	G0145	Smurfit Stone Container Corporation - Retired 8/15/2002	TRUE	Los Angeles	Los Angeles	CA	N/A
Cogeneration	G0149	Corona Cogen	FALSE	Corona	Riverside	CA	47.0
Cogeneration	G0157	Pitchess Cogeneration Station	FALSE	Saugus	Los Angeles	CA	28.7
Cogeneration	G0159	Solano County Cogeneration Plant	FALSE	Fairfield	Solano	CA	2.9
Cogeneration	G0161	Crockett Cogeneration Project	FALSE	Crockett	Contra Costa	CA	247.4
Cogeneration	G0173	Western Power and Steam Inc. (DAI Oildale)	FALSE	Bakersfield	Kern	CA	28.4
Cogeneration	G0176	Double C	FALSE	Bakersfield	Kern	CA	48.0
Cogeneration	G0177	Pittsburg - Retired 3/8/2010	TRUE	Pittsburg	Contra Costa	CA	N/A
Cogeneration	G0180	EF Oxnard Inc.	FALSE	Oxnard	Ventura	CA	48.5
Cogeneration	G0184	Byron Power Partners LP - Retired 12/31/2010	TRUE	Unincorporated	Alameda	CA	N/A
Cogeneration	G0202	ExxonMobil Las Flores Canyon	FALSE	Goleta	Santa Barbara	CA	49.8
Cogeneration	G0203	NP Cogen Inc. - Retired 12/31/2001	TRUE	Commerce	Los Angeles	CA	N/A
Cogeneration	G0216	Frito-Lay (Kern Plant)	FALSE	Bakersfield	Kern	CA	6.1
Cogeneration	G0221	OLS Energy - Agnews Inc.	FALSE	San Jose	Santa Clara	CA	30.5
Cogeneration	G0224	Gaylord Container Corp Antioch - Retired 11/01/2002	TRUE	Antioch	Contra Costa	CA	N/A
Cogeneration	G0225	General Mills Operations Inc. Lodi Plant	FALSE	Lodi	San Joaquin	CA	3.4

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Cogeneration	G0229	Calpine Gilroy Cogen L.P.	FALSE	Gilroy	Santa Clara	CA	123.4
Cogeneration	G0233	Goal Line LP	FALSE	Escondido	San Diego	CA	49.9
Cogeneration	G0238	Greenleaf 1 Inc.	FALSE	Yuba City	Sutter	CA	72.0
Cogeneration	G0239	Greenleaf 2 Inc.	FALSE	Yuba City	Sutter	CA	50.0
Cogeneration	G0241	Grossmont Hospital	FALSE	La Mesa	San Diego	CA	N/A
Cogeneration	G0246	Harbor Cogeneration Co	FALSE	Wilmington	Los Angeles	CA	107.5
Cogeneration	G0254	Hershey Chocolate Confectionery Oakdale Plant - Retired 2/31/2011	TRUE	Oakdale	Stanislaus	CA	N/A
Cogeneration	G0258	High Sierra	FALSE	Bakersfield	Kern	CA	48.0
Cogeneration	G0262	Los Angeles Cold Storage - Retired 12/31/2003	TRUE	Los Angeles	Los Angeles	CA	N/A
Cogeneration	G0280	Ontario Linerboard Mill	FALSE	Ontario	San Bernardino	CA	34.0
Cogeneration	G0281	UTC Aerospace Systems Cogeneration Plant	FALSE	Chula Vista	San Diego	CA	9.5
Cogeneration	G0282	Napa State Hospital - Retired 12/31/2013	TRUE	Napa	Napa	CA	N/A
Cogeneration	G0283	JRW Associates LP - Retired 12/31/2011	TRUE	Winton	Merced	CA	N/A
Cogeneration	G0286	Kingsburg Cogeneration	FALSE	Kingsburg	Fresno	CA	34.5
Cogeneration	G0290	CP Kelco - San Diego Plant	FALSE	San Diego	San Diego	CA	28.0
Cogeneration	G0292	Kern Front	FALSE	Bakersfield	Kern	CA	48.0
Cogeneration	G0293	Kern River Cogeneration Co	FALSE	Bakersfield	Kern	CA	300.0
Cogeneration	G0298	Kyocera Project	FALSE	San Diego	San Diego	CA	3.7
Cogeneration	G0315	Live Oak Cogen	FALSE	Bakersfield	Kern	CA	47.0
Cogeneration	G0317	Loma Linda University Cogeneration	FALSE	Loma Linda	San Bernardino	CA	11.6
Cogeneration	G0339	McKittrick Cogen	FALSE	McKittrick	Kern	CA	47.0
Cogeneration	G0355	Mid-Set Cogeneration	FALSE	Taft	Kern	CA	39.1
Cogeneration	G0358	Midway-Sunset Cogeneration	FALSE	Fellows	Kern	CA	234.0
Cogeneration	G0363	ExxonMobil Torrance Refinery	FALSE	Torrance	Los Angeles	CA	49.3
Cogeneration	G0366	Lake Shore Mojave LLC - Retired 8/5/2013	TRUE	Boron	Kern	CA	N/A

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Cogeneration	G0368	Berry Cogen Midway-Sunset 18MW	FALSE	Maricopa	Kern	CA	18.4
Cogeneration	G0378	Mule Creek State Prison - Retired 1/26/2016	TRUE	Ione	Amador	CA	3.0
Cogeneration	G0384	Fresno Cogeneration Partners LP	FALSE	San Joaquin	Fresno	CA	58.3
Cogeneration	G0385	Naval Training Center - Retired 12/31/2003	TRUE	San Diego	San Diego	CA	N/A
Cogeneration	G0386	NTC MCRD Energy Facility	FALSE	San Diego	San Diego	CA	25.6
Cogeneration	G0388	Naval Hospital Medical Center	FALSE	San Diego	San Diego	CA	5.3
Cogeneration	G0389	Naval Station - Retired 12/31/2003	TRUE	San Diego	San Diego	CA	N/A
Cogeneration	G0396	Westend Facility	FALSE	Trona	San Bernardino	CA	17.3
Cogeneration	G0398	North Island - Retired 12/31/2003	TRUE	Coronado	San Diego	CA	N/A
Cogeneration	G0399	North Island Energy Facility	FALSE	Coronado	San Diego	CA	46.2
Cogeneration	G0403	CI Power Cogeneration Plant (OLS Camarillo)	FALSE	Camarillo	Ventura	CA	31.2
Cogeneration	G0404	OLS Energy Chino	FALSE	Chino	San Bernardino	CA	31.2
Cogeneration	G0405	PE Berkeley Inc.	FALSE	Berkeley	Alameda	CA	26.4
Cogeneration	G0409	Oildale - Retired 1/5/2016	TRUE	Bakersfield	Kern	CA	40.0
Cogeneration	G0415	Black Hills Ontario Facility -Retired 2/1/2009	TRUE	Ontario	San Bernardino	CA	N/A
Cogeneration	G0424	Oroville Cogeneration LP	FALSE	Oroville	Butte	CA	7.5
Cogeneration	G0428	Bear Mountain Cogen	FALSE	Bakersfield	Kern	CA	47.0
Cogeneration	G0429	Chalk Cliff Cogen	FALSE	Maricopa	Kern	CA	47.0
Cogeneration	G0434	Palomar Medical Center	FALSE	Escondido	San Diego	CA	N/A
Cogeneration	G0437	Paper-Pak Industries - Retired 12/31/2008	TRUE	La Verne	Los Angeles	CA	N/A
Cogeneration	G0453	Point Arguello Pipeline Co.(Gaviota)	FALSE	Goleta	Santa Barbara	CA	17.5
Cogeneration	G0467	Sacramento SCA	FALSE	Sacramento	Sacramento	CA	147.9
Cogeneration	G0468	The Procter & Gamble Paper Products Co.	FALSE	Oxnard	Ventura	CA	69.8
Cogeneration	G0475	Qualcomm Building P Central Plant	FALSE	San Diego	San Diego	CA	4.6
Cogeneration	G0477	Richard J Donovan Correctional Facility - Retired 12/31/2007	TRUE	San Diego	San Diego	CA	N/A

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Cogeneration	G0483	Plant No 1	FALSE	Fountain Valley	Orange	CA	7.5
Cogeneration	G0494	Rhodia - Martinez	FALSE	Martinez	Contra Costa	CA	4.0
Cogeneration	G0495	Rhodia Dominguez Plant	FALSE	Carson	Los Angeles	CA	5.0
Cogeneration	G0509	C&H Sugar Plant	FALSE	Crockett	Contra Costa	CA	8.0
Cogeneration	G0511	San Diego State University	FALSE	San Diego	San Diego	CA	14.3
Cogeneration	G0515	SRI International Cogen Project	FALSE	Menlo Park	San Mateo	CA	6.0
Cogeneration	G0516	South Belridge Cogen Facility	FALSE	McKittrick	Kern	CA	60.0
Cogeneration	G0518	Saint Agnes Medical Center	FALSE	Fresno	Fresno	CA	7.0
Cogeneration	G0520	Salinas River Cogeneration	FALSE	San Ardo	Monterey	CA	38.9
Cogeneration	G0521	Salk Institute - Retired 7/1/2004	TRUE	La Jolla	San Diego	CA	N/A
Cogeneration	G0522	San Antonio Community Hospital	FALSE	Upland	San Bernardino	CA	2.7
Cogeneration	G0527	NRG Energy Inc.	FALSE	San Diego	San Diego	CA	1.5
Cogeneration	G0529	San Joaquin Cogen	FALSE	Lathrop	San Joaquin	CA	48.0
Cogeneration	G0536	Algonquin Power Sanger LLC	FALSE	Sanger	Fresno	CA	73.0
Cogeneration	G0541	UC Santa Cruz Cogeneration	FALSE	Santa Cruz	Santa Cruz	CA	4.4
Cogeneration	G0547	Sargent Canyon Cogeneration	FALSE	San Ardo	Monterey	CA	38.2
Cogeneration	G0551	4160 V Cogeneration System - Retired 12/31/2003	TRUE	San Diego	San Diego	CA	N/A
Cogeneration	G0556	Weir Cogeneration Plant - Retired 12/31/2006	TRUE	Fellows	Kern	CA	N/A
Cogeneration	G0557	Coalinga Cogeneration Facility	FALSE	Coalinga	Fresno	CA	7.0
Cogeneration	G0558	Southeast Kern River Cogen	FALSE	Bakersfield	Kern	CA	30.9
Cogeneration	G0562	AltaGas Pomona Energy Inc. (cogen prior to 2016)	FALSE	Pomona	Los Angeles	CA	46.3
Cogeneration	G0563	Wheelabrator Lassen - Retired 5/21/2013	TRUE	Anderson	Shasta	CA	N/A
Cogeneration	G0564	Ripon Cogeneration Facility	FALSE	Ripon	San Joaquin	CA	49.5
Cogeneration	G0565	Blue Heron Paper - Retired 1/1/2007	TRUE	Pomona	Los Angeles	CA	N/A
Cogeneration	G0582	Saint Johns Health Center - Retired 1/1/2004	TRUE	Santa Monica	Los Angeles	CA	N/A

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Cogeneration	G0588	Coldgen; Sunlaw - Retired 9/30/2002	TRUE	Vernon	Los Angeles	CA	N/A
Cogeneration	G0589	Sunnyside Cogeneration Partners LP - Retired 12/31/2008	TRUE	Salinas	Monterey	CA	N/A
Cogeneration	G0590	Sycamore Cogeneration Co	FALSE	Bakersfield	Kern	CA	300.0
Cogeneration	G0595	A Fee Cogeneration Plant - Retired 3/14/2011	TRUE	Bakersfield	Kern	CA	N/A
Cogeneration	G0596	B Fee Cogeneration Plant - Retired 3/14/2011	TRUE	Bakersfield	Kern	CA	N/A
Cogeneration	G0597	C Fee Cogeneration Plant - Retired 3/14/2011	TRUE	Bakersfield	Kern	CA	N/A
Cogeneration	G0599	Lost Hills Cogeneration Plant	FALSE	Lost Hills	Kern	CA	9.0
Cogeneration	G0600	McKittrick Cogeneration Plant	FALSE	McKittrick	Kern	CA	11.2
Cogeneration	G0601	North Midway Cogeneration Plant - Retired 5/9/2014	TRUE	McKittrick	Kern	CA	N/A
Cogeneration	G0613	Martinez Cogen Limited	FALSE	Martinez	Contra Costa	CA	115.2
Cogeneration	G0621	Techni-Cast - Retired 4/1/2013	TRUE	South Gate	Los Angeles	CA	N/A
Cogeneration	G0625	U S Borax Inc.	FALSE	Boron	Kern	CA	42.0
Cogeneration	G0626	Naval Station Energy Facility	FALSE	San Diego	San Diego	CA	49.9
Cogeneration	G0627	Dome Lease Project	FALSE	Fellows	Kern	CA	6.0
Cogeneration	G0630	Phillips66 - Carbon Plant	FALSE	Rodeo	Contra Costa	CA	27.3
Cogeneration	G0632	ConocoPhillips Company San Francisco Refinery	FALSE	Rodeo	Contra Costa	CA	49.3
Cogeneration	G0633	Union Tribune Publishing Co	FALSE	San Diego	San Diego	CA	N/A
Cogeneration	G0636	United Cogen Inc. (SFO) - Retired 3/31/2012	TRUE	Unincorporated	San Mateo	CA	N/A
Cogeneration	G0638	Berry Cogen Midway-Sunset 38MW	FALSE	Taft	Kern	CA	37.2
Cogeneration	G0639	University of California Davis - Retired 12/31/2005	TRUE	Davis	Yolo	CA	N/A
Cogeneration	G0640	University of California San Diego Cogeneration Facility	FALSE	La Jolla	San Diego	CA	30.0
Cogeneration	G0641	Univ. of San Francisco Cogen	FALSE	San Francisco	San Francisco	CA	1.5
Cogeneration	G0643	Rincon Facility - Retired 12/31/2005	TRUE	Ventura	Ventura	CA	N/A
Cogeneration	G0644	Welport Lease Project	FALSE	McKittrick	Kern	CA	5.0
Cogeneration	G0646	VA San Diego Cogeneration Plant (VA Hospital)	FALSE	San Diego	San Diego	CA	N/A

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Cogeneration	G0653	Veterans Home of California - Retired 12/31/2004	TRUE	Yountville	Napa	CA	N/A
Cogeneration	G0658	Centaur Generator Facility - Retired 8/1/08	TRUE	Ventura	Ventura	CA	N/A
Cogeneration	G0661	Watsonville - Retired 5/27/2010	TRUE	Watsonville	Santa Cruz	CA	N/A
Cogeneration	G0673	Wheelabrator Norwalk Energy	FALSE	Norwalk	Los Angeles	CA	29.0
Cogeneration	G0677	New-Indy Containerboard Ontario (formerly Oxnard Paper Mill)	FALSE	Oxnard	Ventura	CA	29.0
Cogeneration	G0686	Yuba City Cogeneration Partners LP	FALSE	Yuba City	Sutter	CA	49.0
Cogeneration	G0746	Qualcomm Building W Power Plant	FALSE	San Diego	San Diego	CA	4.5
Cogeneration	G0751	Ingredion Stockton Plant	FALSE	Stockton	San Joaquin	CA	2.8
Cogeneration	G0755	Martinez Refinery	FALSE	Martinez	Contra Costa	CA	98.5
Cogeneration	G0757	California Institute of Technology	FALSE	Pasadena	Los Angeles	CA	12.5
Cogeneration	G0758	Civic Center Cogen	FALSE	Los Angeles	Los Angeles	CA	23.0
Cogeneration	G0759	ConocoPhillips Los Angeles Refinery Wilmington Plant	FALSE	Wilmington	Los Angeles	CA	68.5
Cogeneration	G0762	St Luke Medical Center - Retired 12/31/2001	TRUE	Pasadena	Los Angeles	CA	N/A
Cogeneration	G0763	UCLA Energy Systems Facility	FALSE	Los Angeles	Los Angeles	CA	43.0
Cogeneration	G0765	Linde Wilmington - Retired 12/31/2002	TRUE	Wilmington	Los Angeles	CA	N/A
Cogeneration	G0775	Elk Hills CoGeneration	FALSE	Tupman	Kern	CA	46.6
Cogeneration	G0776	Los Angeles Refinery (Tesoro)	FALSE	Wilmington	Los Angeles	CA	83.0
Cogeneration	G0802	AERA San Ardo Cogen Facility	FALSE	San Ardo	Monterey	CA	6.0
Cogeneration	G0803	Central Utility Plant (LAX)	FALSE	Los Angeles	Los Angeles	CA	8.0
Cogeneration	G0804	Linn Western Processing Generating Facility (Blacksand)	FALSE	Brea	Orange	CA	8.3
Cogeneration	G0899	Olive View Medical Center	FALSE	Sylmar	Los Angeles	CA	5.8
Cogeneration	G0902	Valero Cogeneration Unit #1	FALSE	Benicia	Solano	CA	47.7
Cogeneration	G0923	Clearwater	FALSE	Corona	Riverside	CA	32.5
Cogeneration	G0930	Bear Valley Power Plant	FALSE	Big Bear Lake	San Bernardino	CA	8.4
Cogeneration	G0986	Navy Regional Data Automation Center - Retired 12/31/2013	TRUE	San Diego	San Diego	CA	N/A

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Cogeneration	G1014	Saddleback Community College	FALSE	Mission Viejo	Orange	CA	1.5
Cogeneration	G1017	Sheraton San Diego East Tower - Retired 8/1/2014	TRUE	San Diego	San Diego	CA	N/A
Cogeneration	G1018	Johnson & Johnson PR&D Plant - Retired 12/31/2011	TRUE	San Diego	San Diego	CA	N/A
Cogeneration	G1019	Central Plant (UC Irvine)	FALSE	Irvine	Orange	CA	19.0
Cogeneration	G1020	Pixley Cogen Plant	FALSE	Pixley	Tulare	CA	12.0
Cogeneration	G1030	Toyota Technical Center	FALSE	Gardena	Los Angeles	CA	1.4
Cogeneration	G1035	Riverside Water Quality Control Plant	FALSE	Riverside	Riverside	CA	4.3
Cogeneration	G1042	Pacific Palms Cogeneration - Retired 12/31/2014	TRUE	City of Industry	Los Angeles	CA	N/A
Cogeneration	G1046	Houweling Nurseries	FALSE	Camarillo	Ventura	CA	13.1
Cogeneration	G1050	Qualcomm Building Q Central Plant	FALSE	San Diego	San Diego	CA	4.6
Cogeneration	G1051	High Sierra Cogeneration Power Plant	FALSE	Susanville	Lassen	CA	6.0
Cogeneration	G1067	John Wayne Airport	FALSE	Santa Ana	Orange	CA	7.0
Cogeneration	G9100	B Braun Medical Inc.	FALSE	Irvine	Orange	CA	6.1
Cogeneration	G9879	USPS Rancho Carmel San Diego - Retired 12/31/2009	TRUE	San Diego	San Diego	CA	N/A
Combined Cycle	G0053	El Segundo Energy Center (Units 5 6 7 8)	FALSE	El Segundo	Los Angeles	CA	526.0
Combined Cycle	G0169	Donald Von Raesfeld Power Plant (DVR)	FALSE	Santa Clara	Santa Clara	CA	147.0
Combined Cycle	G0190	El Centro Generating Station	FALSE	El Centro	Imperial	CA	152.3
Combined Cycle	G0213	Roseville Energy Park (REP)	FALSE	Roseville	Placer	CA	200.0
Combined Cycle	G0249	Haynes Generating Station	FALSE	Long Beach	Los Angeles	CA	630.0
Combined Cycle	G0329	Magnolia	FALSE	Burbank	Los Angeles	CA	387.6
Combined Cycle	G0372	Moss Landing Power Plant	FALSE	Moss Landing	Monterey	CA	1,080.0
Combined Cycle	G0648	Valley Generating Station	FALSE	Sun Valley	Los Angeles	CA	690.4
Combined Cycle	G0778	High Desert Power Project	FALSE	Victorville	San Bernardino	CA	854.9
Combined Cycle	G0779	Sutter Energy Center - Calpine Construction Finance Co	FALSE	Yuba City	Sutter	CA	551.8
Combined Cycle	G0780	Los Medanos Energy Center LLC	FALSE	Pittsburg	Contra Costa	CA	594.0

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Combined Cycle	G0781	La Paloma Generating	FALSE	McKittrick	Kern	CA	1,200.0
Combined Cycle	G0783	Delta Energy Center LLC	FALSE	Pittsburg	Contra Costa	CA	860.2
Combined Cycle	G0784	Sunrise Power	FALSE	Fellows	Kern	CA	572.0
Combined Cycle	G0785	Otay Mesa Generating Project	FALSE	San Diego	San Diego	CA	689.0
Combined Cycle	G0787	Blythe Energy Project	FALSE	Blythe	Riverside	CA	537.0
Combined Cycle	G0794	Metcalf Energy Center LLC	FALSE	San Jose	Santa Clara	CA	565.8
Combined Cycle	G0795	Mountainview Generating Station	FALSE	Redlands	San Bernardino	CA	1,054.0
Combined Cycle	G0797	Pastoria Energy Facility L.L.C.	FALSE	Lebec	Kern	CA	778.0
Combined Cycle	G0799	Elk Hills Power LLC	FALSE	Tupman	Kern	CA	567.0
Combined Cycle	G0838	Tracy Peaker Plant (reconfigured from Peaker to CC 2012)	FALSE	Tracy	San Joaquin	CA	333.0
Combined Cycle	G0861	Palomar Energy Center	FALSE	Escondido	San Diego	CA	559.0
Combined Cycle	G0866	Los Esteros Critical Energy Facility LLC	FALSE	San Jose	Santa Clara	CA	325.7
Combined Cycle	G0868	Inland Empire Energy Center	FALSE	Menifee	Riverside	CA	810.0
Combined Cycle	G0889	Cosumnes Power Plant	FALSE	Herald	Sacramento	CA	530.0
Combined Cycle	G0894	Malburg Power Plant	FALSE	Vernon	Los Angeles	CA	139.4
Combined Cycle	G0900	Walnut Energy Center	FALSE	Turlock	Stanislaus	CA	250.0
Combined Cycle	G0934	Colusa Generating Station	FALSE	Colusa	Colusa	CA	692.0
Combined Cycle	G0935	Russell City Energy Company LLC	FALSE	Hayward	Alameda	CA	625.0
Combined Cycle	G0950	Gateway Generating Station	FALSE	Antioch	Contra Costa	CA	613.1
Combined Cycle	G1009	Lodi Energy Center	FALSE	Lodi	San Joaquin	CA	292.2
Combined Cycle	G1040	Desert Star Energy Center (NV)	FALSE	Boulder City	Clark	NV	536.0
Combined Cycle	G9786	Termoelectrica de Mexicali (TDM Mexicali Mexico)	FALSE	Mexicali	Mexicali	MX	680.9
Combined Cycle	G9787	La Rosita (INTERGEN Mexicali Mexico)	FALSE	Mexicali	Mexicali	MX	676.5
Miscellaneous	G0127	SF Fuel Cell Station	FALSE	San Francisco	San Francisco	CA	1.6
Miscellaneous	G0128	Lathrop Plant	FALSE	Lathrop	San Joaquin	CA	4.0

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Miscellaneous	G0175	Division - Retired 12/31/2003	TRUE	San Diego	San Diego	CA	N/A
Miscellaneous	G0190	El Centro Generating Station	FALSE	El Centro	Imperial	CA	124.4
Miscellaneous	G0245	Harbor	FALSE	Wilmington	Los Angeles	CA	245.7
Miscellaneous	G0259	Riverside Canal Power - Retired 12/31/2004	TRUE	Grand Terrace	San Bernardino	CA	N/A
Miscellaneous	G0268	Humboldt Bay	FALSE	Eureka	Humboldt	CA	167.0
Miscellaneous	G0274	Huntington Beach (AES)	FALSE	Huntington Beach	Orange	CA	N/A
Miscellaneous	G0487	Redding Power	FALSE	Redding	Shasta	CA	109.3
Miscellaneous	G0523	Mountainview Power - Retired 12/31/2005	TRUE	San Bernardino	San Bernardino	CA	N/A
Miscellaneous	G0568	Patio Test Cell Solar Turbines Inc. - Retired 12/31/2001	TRUE	San Diego	San Diego	CA	N/A
Miscellaneous	G0578	UCSB Fuel Cell	FALSE	Santa Barbara	Santa Barbara	CA	0.2
Miscellaneous	G0592	South Generator	FALSE	Buttonwillow	Kern	CA	2.0
Miscellaneous	G0593	North Generator	FALSE	Buttonwillow	Kern	CA	2.0
Miscellaneous	G0642	Unocal Fred L Hartley Research Center - Retired 12/31/2001	TRUE	Brea	Orange	CA	N/A
Miscellaneous	G0679	Woodland Generation Station	FALSE	Modesto	Stanislaus	CA	87.0
Miscellaneous	G0754	Grogen Sunlaw (Growers) - Retired 9/30/2002	TRUE	Vernon	Los Angeles	CA	N/A
Miscellaneous	G0756	Television City Cogen LP	FALSE	Los Angeles	Los Angeles	CA	N/A
Miscellaneous	G0925	THUMS	FALSE	Long Beach	Los Angeles	CA	47.8
Miscellaneous	G0990	Solar Turbines Inc. - Kearny Mesa Plant (Testing Only)	FALSE	San Diego	San Diego	CA	9.9
Miscellaneous	G0991	Solar Turbines Inc. - Harbor Drive Plant (Testing Only)	FALSE	San Diego	San Diego	CA	9.9
Miscellaneous	G1024	Fuel Cell DFC	FALSE	Santa Rosa	Sonoma	CA	1.4
Miscellaneous	G1028	CSU East Bay Fuel Cell	FALSE	Hayward	Alameda	CA	1.4
Miscellaneous	G1034	COBUG - City of Palo Alto Backup Generator	FALSE	Santa Clara	Santa Clara	CA	3.4
Miscellaneous	G1047	San Jose-Santa Clara Regional Wastewater Facility	FALSE	San Jose	Santa Clara	CA	11.8
Miscellaneous	G1048	California State - San Bernardino Fuel Cell Unit	FALSE	San Bernardino	San Bernardino	CA	1.4
Peaker	G0011	Alamitos	FALSE	Long Beach	Los Angeles	CA	N/A

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Peaker	G0016	Almond Power Plant	FALSE	Modesto	Stanislaus	CA	223.0
Peaker	G0026	Anaheim CT	FALSE	Anaheim	Orange	CA	49.3
Peaker	G0058	Canyon Power Plant	FALSE	Anaheim	Orange	CA	200.5
Peaker	G0063	Lake 1	FALSE	Burbank	Los Angeles	CA	60.5
Peaker	G0130	Coachella	FALSE	Coachella	Riverside	CA	92.4
Peaker	G0189	El Cajon	FALSE	El Cajon	San Diego	CA	13.0
Peaker	G0195	Ellwood Generating Station	FALSE	Goleta	Santa Barbara	CA	56.7
Peaker	G0196	Encina	FALSE	Carlsbad	San Diego	CA	14.0
Peaker	G0204	MID Ripon	FALSE	Ripon	San Joaquin	CA	100.0
Peaker	G0220	Malaga Peaking Plant	FALSE	Fresno	Fresno	CA	98.0
Peaker	G0228	Gianera	FALSE	Santa Clara	Santa Clara	CA	50.0
Peaker	G0231	Glenarm	FALSE	Pasadena	Los Angeles	CA	178.6
Peaker	G0236	Grayson	FALSE	Glendale	Los Angeles	CA	49.0
Peaker	G0245	Harbor	FALSE	Wilmington	Los Angeles	CA	302.5
Peaker	G0249	Haynes Generating Station	FALSE	Long Beach	Los Angeles	CA	649.1
Peaker	G0289	Kearny	FALSE	San Diego	San Diego	CA	112.0
Peaker	G0319	Long Beach Generation LLC	FALSE	Long Beach	Los Angeles	CA	260.0
Peaker	G0330	Mandalay Generating Station	FALSE	Oxnard	Ventura	CA	138.1
Peaker	G0335	McClellan	FALSE	Sacramento	Sacramento	CA	74.2
Peaker	G0336	McClure	FALSE	Modesto	Stanislaus	CA	112.0
Peaker	G0357	MMC Mid-Sun LLC - Retired 4/1/2009	TRUE	Fellows	Kern	CA	N/A
Peaker	G0360	San Diego Combustion Turbines - Miramar 1A 1B	FALSE	San Diego	San Diego	CA	33.0
Peaker	G0379	Alameda	FALSE	Alameda	Alameda	CA	54.8
Peaker	G0380	Lodi	FALSE	Lodi	San Joaquin	CA	27.4
Peaker	G0381	Lodi CC (NCPA STIG)	FALSE	Lodi	San Joaquin	CA	27.4

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Peaker	G0382	Roseville	FALSE	Rocklin	Placer	CA	49.8
Peaker	G0467	Sacramento SCA	FALSE	Sacramento	Sacramento	CA	50.0
Peaker	G0487	Redding Power	FALSE	Redding	Shasta	CA	73.8
Peaker	G0504	Rockwood Gas Turbine Plant	FALSE	Brawley	Imperial	CA	25.0
Peaker	G0512	Sentinel Energy Project CPV	FALSE	North Palm Springs	Riverside	CA	800.0
Peaker	G0652	Vernon (includes H. Gonzales)	FALSE	Vernon	Los Angeles	CA	11.8
Peaker	G0662	Walnut	FALSE	Turlock	Stanislaus	CA	48.0
Peaker	G0679	Woodland Generation Station	FALSE	Modesto	Stanislaus	CA	98.0
Peaker	G0784	Sunrise Power	FALSE	Fellows	Kern	CA	N/A
Peaker	G0818	Indigo Generation LLC	FALSE	North Palm Springs	Riverside	CA	135.0
Peaker	G0819	Larkspur Energy LLC	FALSE	San Diego	San Diego	CA	90.0
Peaker	G0821	Drews - Agua Mansa (Alliance Colton)	FALSE	Colton	San Bernardino	CA	45.6
Peaker	G0822	Gilroy Energy Center	FALSE	Gilroy	Santa Clara	CA	141.9
Peaker	G0823	King City Energy Center	FALSE	King City	Monterey	CA	47.3
Peaker	G0832	Hanford Energy Park Peaker	FALSE	Hanford	Kings	CA	92.0
Peaker	G0838	Tracy Peaker Plant (reconfigured from Peaker to CC 2012)	FALSE	Tracy	San Joaquin	CA	N/A
Peaker	G0842	Century (Alliance)	FALSE	Colton	San Bernardino	CA	45.6
Peaker	G0845	Enterprise - CalPeak Power	FALSE	Escondido	San Diego	CA	48.9
Peaker	G0853	Border - CalPeak Power	FALSE	San Diego	San Diego	CA	49.8
Peaker	G0866	Los Esteros Critical Energy Facility LLC	FALSE	San Jose	Santa Clara	CA	N/A
Peaker	G0867	Henrietta Peaker	FALSE	Lemoore	Kings	CA	98.0
Peaker	G0896	Chowchilla II Peaker	FALSE	Chowchilla	Madera	CA	49.6
Peaker	G0897	Red Bluff	FALSE	Red Bluff	Tehama	CA	44.8
Peaker	G0904	Fresno Cogeneration Partners LP PKR	FALSE	San Joaquin	Fresno	CA	21.3
Peaker	G0905	Wellhead Power Panoche LLC	FALSE	Firebaugh	Fresno	CA	49.9

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Peaker	G0906	Wellhead Power Gates LLC - Retired 12/31/2011	TRUE	Huron	Fresno	CA	N/A
Peaker	G0908	Panoche - CalPeak Power	FALSE	Firebaugh	Fresno	CA	49.6
Peaker	G0909	Vaca Dixon - CalPeak Power	FALSE	Vacaville	Solano	CA	49.9
Peaker	G0910	Cuyamaca Peak Energy Plant (formerly CalPeak El Cajon)	FALSE	El Cajon	San Diego	CA	46.8
Peaker	G0911	Agua Mansa Power Plant	FALSE	Colton	San Bernardino	CA	60.5
Peaker	G0912	Springs Generation Project	FALSE	Riverside	Riverside	CA	40.0
Peaker	G0913	Wolfskill Energy Center	FALSE	Suisan City	Solano	CA	48.1
Peaker	G0914	Riverview Energy Center	FALSE	Antioch	Contra Costa	CA	47.3
Peaker	G0915	Lambie Energy Center	FALSE	Suisan City	Solano	CA	48.1
Peaker	G0916	Goose Haven Energy Center	FALSE	Suisan City	Solano	CA	48.1
Peaker	G0917	Feather River Energy Center	FALSE	Yuba City	Sutter	CA	48.1
Peaker	G0918	Creed Energy Center LLC	FALSE	Suisan City	Solano	CA	48.1
Peaker	G0919	Yuba City Energy Center	FALSE	Yuba City	Sutter	CA	48.1
Peaker	G0922	Riverside Energy Resource Center	FALSE	Riverside	Riverside	CA	192.0
Peaker	G0924	Chula Vista Energy Center LLC	FALSE	San Diego	San Diego	CA	44.0
Peaker	G0928	Walnut Creek Energy Park	FALSE	City of Industry	Los Angeles	CA	500.5
Peaker	G0931	Niland Gas Turbine Plant	FALSE	Niland	Imperial	CA	121.0
Peaker	G0945	Escondido Energy Center LLC	FALSE	Escondido	San Diego	CA	49.9
Peaker	G0951	El Cajon Energy Center	FALSE	El Cajon	San Diego	CA	49.2
Peaker	G0997	Panoche Energy Center	FALSE	Fresno	Fresno	CA	400.0
Peaker	G0998	Midway LLC - Starwood Power - CalPeak Power	FALSE	Fresno	Fresno	CA	119.5
Peaker	G1005	Orange Grove Energy	FALSE	Pala	San Diego	CA	100.0
Peaker	G1011	Marsh Landing Generating Station	FALSE	Antioch	Contra Costa	CA	828.0
Peaker	G1015	Mariposa Energy LLC	FALSE	Unincorporated	Alameda	CA	200.0
Peaker	G1023	Miramar Energy Facility 1 & 2	FALSE	San Diego	San Diego	CA	95.0

Category	Plant ID	Plant Name	Retired Plant Flag	City	County	State	2015 Capacity (MW)
Peaker	G1034	COBUG - City of Palo Alto Backup Generator	FALSE	Santa Clara	Santa Clara	CA	1.1
Peaker	G1041	McGrath Peaker	FALSE	Oxnard	Ventura	CA	49.0
Peaker	G1049	Delano Energy Center LLC	FALSE	Unincorporated	Tulare	CA	49.9
Peaker	G9111	Barre Peaker	FALSE	Stanton	Orange	CA	49.0
Peaker	G9222	Center Peaker	FALSE	Norwalk	Los Angeles	CA	48.0
Peaker	G9333	Etiwanda Peaker	FALSE	Rancho Cucamonga	San Bernardino	CA	49.0
Peaker	G9444	Mira Loma Peaker	FALSE	Ontario	San Bernardino	CA	49.0
						Grand Total	**48,180.8**

Source: QFER CEC-1304 Power Plant Data Reporting.